Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

PAPERS

IN

POLITE ARTS.

The SILVER MEDAL *was this Session voted to Mrs.* M. A. WARREN, *of Glasgow, for a Piano Monitor. The following Communications were received from her on the subject.*

SIR,

HAVING for many years practised music as a teacher, my inclination and duty have led me to try every improvement that presented itself within the scope of my imagination, not only to inform my pupils of the principles which lead to the science of music, but also to form their habits so as to direct their practice to the attainment of its object: I need not, nor can I, perhaps, describe the methods pursued by different teachers with various success, whilst some have proved very prejudicial, and laid the foundation of errors fatal both to principle and execution.

To correct these errors (which generally arise from improper methods, or negligence when commencing with young beginners) has engaged a portion of my attention.

One of the greatest faults in execution I have had to combat was weakness in one or both wrists, occasioned often by inattention in the teacher; sometimes from stubbornness or indolence in the pupil, no matter from whom or whence the fault is derived, all the first teachers agree in considering it as fatal to the attaining any degree of perfection on the piano forte. To provide against the failing I have alluded to, and to assist both the teacher in conveying, and pupil in gaining the necessary and elegant command of the instrument, I have attempted to construct an assistant for the wrist, which I have named the Piano Monitor.

With the greatest diffidence I present it to the Society of Arts for their inspection. The conviction I have of its utility, from the success with which I have applied it, gives me reason to hope it will in some degree be found worthy their attention. I must apologize for the want of mechanical knowledge it doubtless will exhibit, by urging that studies of this kind seldom form any part of female education. I have endeavoured to render it simple, so that a child can regulate it, which I conceive a very essential point to gain. Its construction, no doubt, can be much improved by those better versed in mechanics; yet, feeling assured of its usefulness, I hope my humble exertions will be of service to those who teach, or learn music, on the piano forte.

Any further communications which may be thought necessary, will be readily attended to by,

Sir,
Your humble Servant,
MARY ANNE WARREN.

83, Thougate, Glasgow.

To A. Aikin, Esq. Sec.

The

The Application of the Piano Monitor.

HAVING before stated the errors which render the invention necessary as a remedy or preventive, I have only to add in what manner I have applied it to assist my pupils in conquering or avoiding the faults incidental to the wrists.

In using it with beginners I find it gives them a steady and even touch; it pitches their wrists to that height which enables them to execute with firmness, and by its having a spring, does not in the least deprive them of that expression and grace which an unmovable rail would contract. I generally pitch it at that height which will allow them to play over it without touching the rail, except in striking an octave. Should they rest upon it, or attempt to strike the keys too harshly, the spring informs both teacher and pupil of the error, and by keeping the wrists in their position, saves trouble to the teacher, whose attention can be directed to other material explanations. The spring is more constant in its attendance than the teacher, being always present to assist their practice, when the absence of the teacher might occasion a relaxation of attention in this particular point. Should a young hand be heavy or stubborn, the screws, *m m*, fig. 1, will fasten one or both ends, so that it will not recede from the pressure of the hand, and will oblige the wrists to keep their height; the Monitor is likewise of great use to those who, whilst advancing in theory, had been allowed in their practice to contract a weakness in their left wrist: for the Monitor rail can be fastened at the left side, whilst the other end is allowed to spring. The Monitor rail can be placed at any distance from the keys by the screw E, keeping the ends parallel to each other with the hand. I had two screws similar to E, one in each of the dove tails C C; but the Monitor appeared too complicated, and I found that one answered the same purpose, and was much better calculated for juvenile comprehension; other methods might be devised for fixing it on the instrument: I have made choice of that which I thought the most simple, as the holes for the pins are but small, and will not injure a piano forte.

The Monitor can be put on and taken off in an instant. I wish it to be particularly observed, it is not intended that the learner should always practise with the Monitor. The great advantage to be derived from its use, is the proper position of the wrists, which if once attained will not easily be lost, as the wrist, being kept up, the sensitive part of the finger will touch the keys, when the Monitor is removed. The finger will necessarily touch the keys with the same part, consequently the wrist must take the same position without, as it was accustomed to with the Monitor.

Reference to the Engraving of Mrs. WARREN'S *Piano Monitor.*

Plate 2, fig. 1, represents the Monitor fixed on the piano. Fig. 2. The Monitor detached from the piano, and viewed in an opposite direction to fig. 1.

A A A, A frame of wood, which is fixed on the piano by means of the pins, B B.

D D, a bar of wood, forming the base of the Monitor, and traversing by means of two dove-tail pieces, in the grooves, C C.

E, A screw working in a collar, and passing through both

Mr Dick's

Fig. 1.

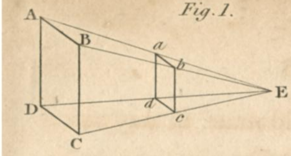


Fig. 2.

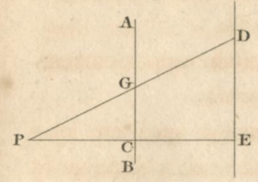
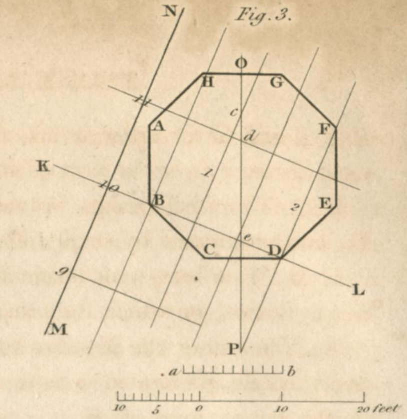


Fig. 3.



Fig

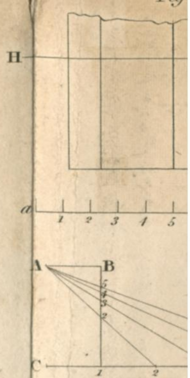
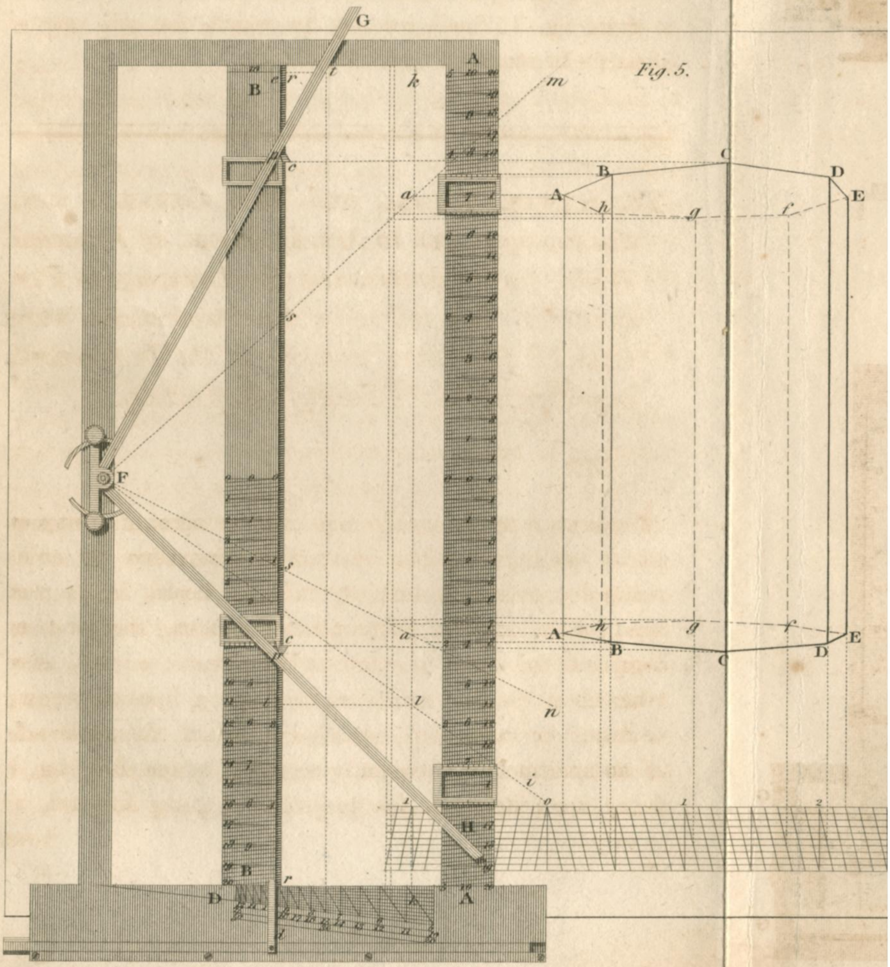


Fig. 5.



Mr Dick's machine for drawing in Perspective.

Fig. 4.

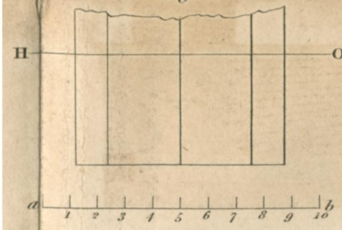


Fig. 10.

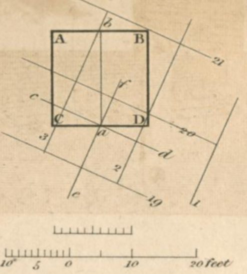


Fig. 8.

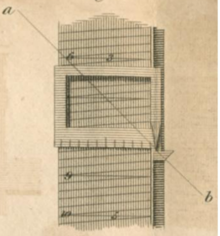
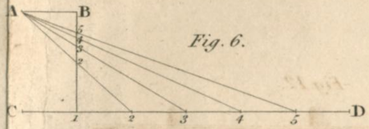


Fig. 6.



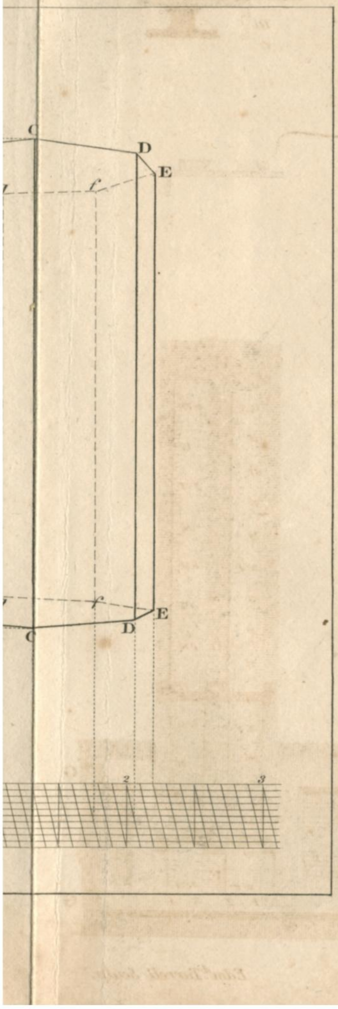
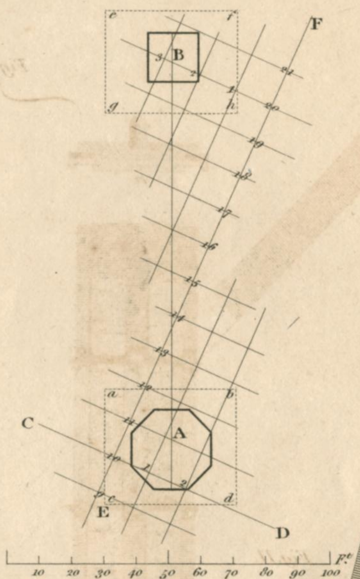
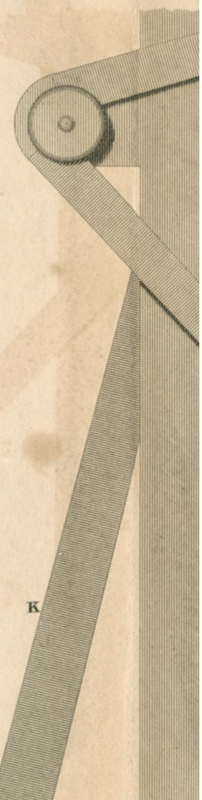


Fig. 9.





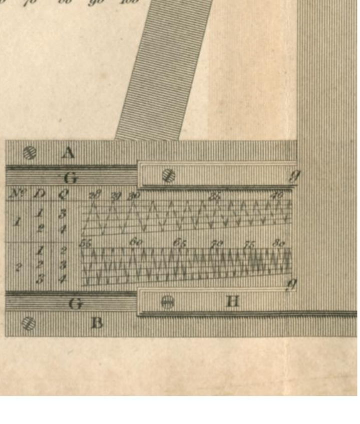


Fig. 8.

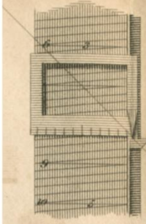


Fig. 7.

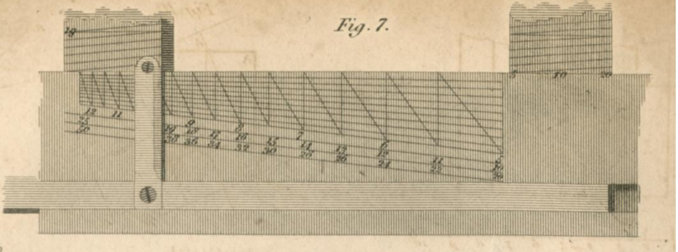
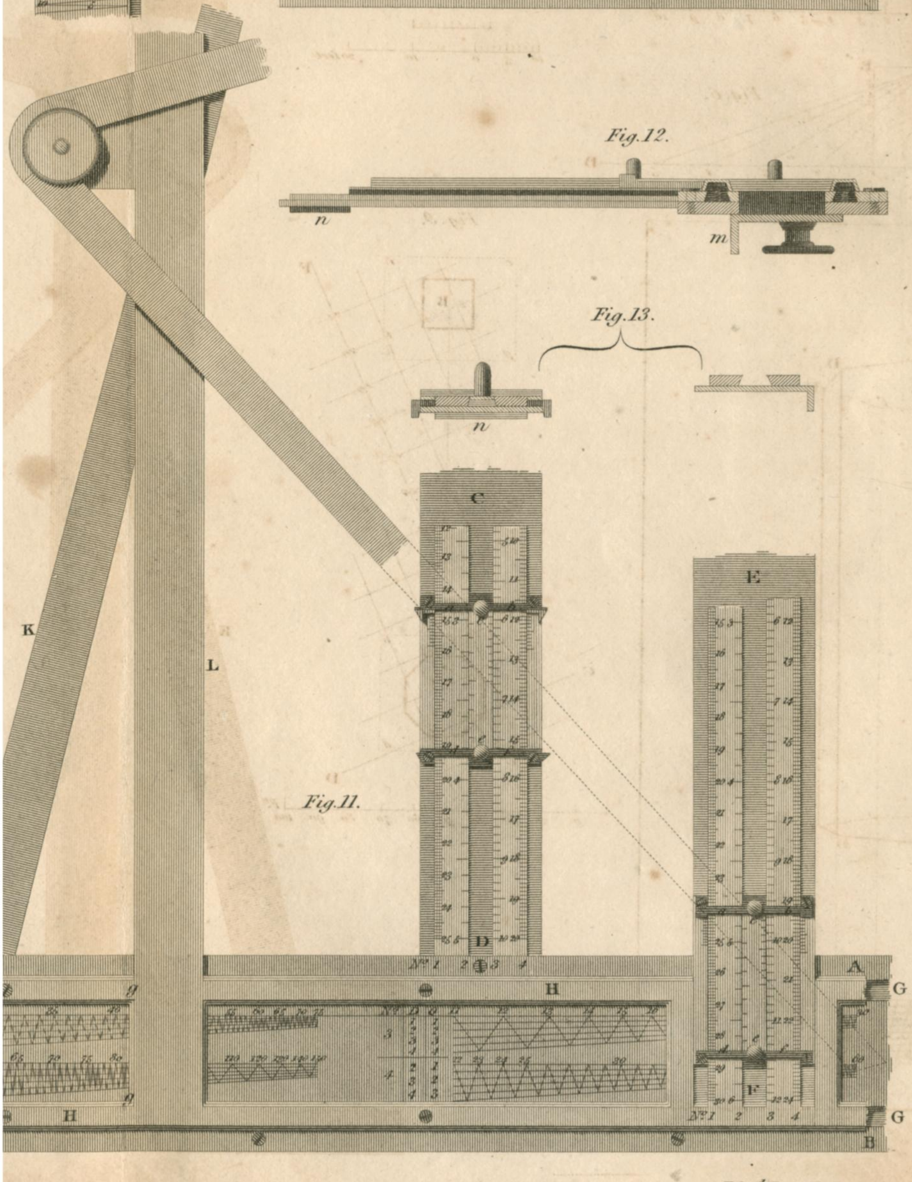


Fig. 12.

Fig. 13.

Fig. 11.



Edmd. Turrell Sculp.

both A and D in order to fix the Monitor at any convenient distance from the keys of the piano.

F F, Two steel springs fastened by screws into the bar, D, and terminated by small rollers, G G.

H H, Two brass pins terminated at their upper extremities as screws, on which the nuts, I I, work.

K, The rail of the Monitor terminated at each end by a brass ferrule, perforated so as to allow the rail to slide easily on the upright pins, H H.

m m, fig. 1. Small screws, by which the rail may at pleasure be rendered motionless.

The SILVER MEDAL *and* TEN GUINEAS *were this Session voted to Mr.* D. DICK, *of Vauxhall Walk, for an Instrument for Drawing in Perspective. The following Communications were received from him, and one of the Instruments is preserved in the Society's Repository.*

SIR,

ACCORDING to the usual mode, and on account of its simplicity, perhaps the best method of perspective for architectural purposes, a separate table or board, beside that used for the drawing, is required for finding the points on a ground line equal in extent to the picture; so that, even when those useful instruments for drawing lines converging to distant or inaccessible centres are applied, the whole side of an apartment is frequently occupied by one drawing, it being requisite while the projection is going forward, to have the plan, with the ground line upon it at hand, to be referred to as found necessary.

Another, and perhaps worse subject of complaint, is the great number of superfluous lines, which must unavoidably be used in finding those which really belong to the picture, and that tend so much to perplex the artist, particularly beginners. Having turned my attention to the means of lessening or removing these inconveniences by some mechanical contrivance, and having succeeded in making an instrument which compleatly answers the purpose, I beg leave to submit it to the consideration of the Society for the Encouragement of Arts, &c. being persuaded that, if adopted, it will be found of considerable service to artists, particularly for pictures at long distances, or when different buildings, lying at considerable distances from each other, are to be represented in the same picture; as they can all be projected by means of the instrument, without being brought into connection in one general plan; and the perspective representations can be made greater or smaller at pleasure, whatever the extent of the plans may happen to be.

In its principle and manner of operation it is so simple, that any one possessing a moderate knowledge of geometric drawing, though entirely unacquainted with the rules of perspective, may learn to use it in half an hour's application, in the projection of the most difficult buildings; and it possesses this singular advantage, that the whole projection may be made by it without putting a line upon the paper which does not belong to the picture. In point of expedition, I believe it will not be found inferior to the most simple method in use, when a facility in working it and in reading the scales has been acquired; and I am persuaded that the accuracy will be found greater with a well made instrument.—That which I have the honour to lay before the Society, it may be proper to state, is rather defective both in execution and construction, having been made and divided by a person who is not a professed mechanist, and without the proper apparatus and implements for such work.

I have, however, proved its powers by projecting several drawings with it, requiring great accuracy, and found it to answer the purpose, imperfect as in many respects its execution is, with as much accuracy as would have been obtained by any other method.

As the invention opens a new, and in all probability an improvable path to the artist, it is submitted in the hope that it will be found, in some degree at least, worthy of the consideration of the Society.

I am, Sir,
Your obedient humble Servant,
DAVID DICK.

No. 5, Vauxhall Walk, February 22, 1817.

To A. Aikin, Esq. Sec.

Explanation of the principle which is employed in using the Instrument.

A perspective representation of any object, it is well known, is the representation of a section of the rays of light, proceeding from the object to the eye of the spectator.

The principle on which such a section, or representation can be made from geometrical projections of the object, is deducible from the doctrine of similar triangles, and may be briefly expressed as follows.

If the rays proceeding from any plane to the eye be intersected by another plane parallel to the first, the corresponding lineal dimensions of the section and original plane will be to each other in the distinct ratio of their distances from the eye.

Thus, suppose A B C D, plate 3, Fig. 1, to be a plane, A E, B C, &c. rays proceeding from it to the eye, E, and *a b c d*, a section of the rays parallel to the plane, A B C D; then, the section and plane are similar in every respect, and the corresponding lines in each, viz, *a b*, A B; *b d*, B D, and *c a*, C A, are to one another, as the distances of their respective planes from E.

To shew in what manner this obvious principle can be applied in the projection of perspective pictures from geometrical plans of objects, let D, fig. 2, be any point in a plane of which D E, is a section, or edge view, P, the point of sight, and A B, a section of the picture plane. From P draw P C, perpendicular to A B, produce it till it meets D E in E, join P D, and the line will cut the picture in G. From the construction it is plain that, P E D, P C G, are similar triangles; consequently P E : P C : E D : C G. Now suppose that P E and D E, which are variable quantities, have been measured in parts of P C, the distance of the picture, which make $\frac{1}{2}$ or unity, and that they have been found P E=2, D E=1, then as before, 2 : 1 : 1 : 5, or simply, $\frac{1}{2}$ = ·5, which shews that the place on the picture of the point D, is five-tenths of P C, distant from the centre, C. In the same manner the place on the picture of any other point in the original plane might be found; or of any other point whatever, of which the distance from the picture can be ascertained, for that distance, together with the known distance of the picture, will be the distance from the eye of a plane supposed to pass through the point parallel to the plane of the picture.

Consequently, having drawn the ground line and a perpendicular to it through its centre, as K L, M N, fig. 3, upon any plan which is to be put into perspective, and having determined the distance of the picture or ground line, it is only necessary to measure in parts of that distance, the distances from the ground line and from its perpendicular, of those points on the plan which are to appear in perspective, and to divide the distances from the perpendicular by the distances from the ground line, added to the distance of that line from the point of sight, in order to find the places of the points on the picture.

Thus, in fig. 3, the distance of the point E, of the plan A B C, &c. from the ground line K L, is ·08; that is, eight one hundredths of the distance of the picture, and from the perpendicular M N, ·238. Adding unity to the first of these numbers therefore we have ·238. divided by 1·08, to find the place on the picture of the point E, which is accordingly ·22 parts of the distance of the picture from its centre; and it is so represented in the perspective projection, fig. 5, the angle E E, being over the division ·22 of the scale below.

The above is the general principle on which the instrument is made to act; it performs the operations in division with great expedition, and at the same time, by a proper relation being preserved between the scales thereon and those adapted to the plans and picture, determines mechanically the points in perspective.

As this sort of explanation, and the use of numbers in the process, give it an appearance of complexity and difficulty which do not belong to it, it is necessary to observe, that the mind has nothing whatever to do with calculations of any kind, in using the Instrument, there being nothing more required than a readiness in reading the scales thereon, and adjusting or setting it by them.

Description of the Instrument, and Explanation of the manner in which it performs the operations in division.

It is represented in figure 5, as lying on a board, in the manner of a T square. The perspective representation of the octagonal prism, may, for the sake of illustration, be supposed to have been projected by the instrument, as in reality it was by means of the figure.

The upper side on which the scales are engraved is brass, the under side is wood, and the whole thickness about two tenths of an inch. The edges of A A, and those of B B, are made parallel to one another, B B, is the blade of a T square, the stock of which is made to slide evenly in a groove, in the bottom of the frame, so that the scale B can be placed any where between the scale A, and the centre F, on which the two limbs, F G, F H, are moveable. The inner edges of these limbs are straight and cut the centre F, or world cut it if produced.—The points *p*, of the sliders on B, and the edge of the plate *d*, which is moveable with B, are all in a line *d e*, parallel to the edges of A. The nature of the scales, A and B, or the dividend and quotient scales, as, from their respective uses, they may be termed, will be seen at once by an inspection of the figure, but it will be necessary to add a short explanation of the nature of the divisor scale D.

For this purpose let A B, C D, fig. 6, be parallel straight lines, one of which C D, is unlimited towards D, and its extremity C, perpendicular under A; B 1 a line falling on both at right angles to them, and 1, 2, 3, 4, &c. distances on C D, each equal to A B. or C 1. Then will the intersections of the lines, A 2, A 3, A 4, and so on, with B 1, in the points 2, 3, 4, form a scale on the same principle as that on the bottom of the Instrument, and similar to a vanishing line in a perspective picture; for, supposing A a point of sight, B 1, a vanishing line, and B the vanishing point of the line C D, the points 2, 3, 4, &c. on B 1, are the projections thereon, of the original points, 2, 3, 4, in C D.

Had this scale been continued on the Instrument to 100, taking the number by the middle line, it would have been complete, or at least would have included all the objects; but the divisions towards 100, would have become too small, and in numerous cases only two places of figures would have been obtained in the quotients, when, for the purpose of drawing accurately three are necessary. As the scales are now arranged, three figures in the quotients can always be obtained, and very often four.

There are three lines of numbers on each scale, which for the sake of description, may be distinguished by first, second, third, from left to right on the dividend scale A, from right to left on the quotient scale B, and downwards on the divisor scale D. The divisions are read for these different lines, thus: On the first line, on A, or B, there are 20 divisions, made by oblique lines, from 0 to 1·0, and from 1·0 to 2·0, and so on, two of these oblique lines, therefore, are a tenth of a primary division; and two of the divisions on the sliders, the edges of which intersect the oblique lines, are a tenth of a secondary, or a hundredth of a primary division, the oblique lines being divided into tenths, by the divisions on the sliders. On the second or middle lines, the primary divisions are plainly divided into tenths, by the oblique lines, and these again, into tenths by the divisions on the sliders—on the third line, the half of each oblique division, or five divisions of the slider, is a tenth of a primary division, and the half of each tenth on the slider, is therefore the tenth of a second division. The divisions on the divisor scale are reckoned in a similar manner.

To set the Instrument, place the edge of the plate *d*, to the division,or number required as a divisor, and the slider on A, to the dividend ; set the edge of the limb to the corner of the slider, and while it is held in that position, make the point *p*, of the slider on B, rest or bear upon its edge, then turn it aside, and the edge of the slider will be found cutting a division on B, at one of its own divisions, and these taken the one after the other, will be the answer.

Thus in fig. 5, it is represented set as described. Taking the middle lines of numbers, the divisor is 193, the dividend 800, and the quotient 414. The divisor and quotient will be more distinctly read on figures 7 and 8, which are parts of fig. 5, enlarged. On fig. 8, the line *a b* stands for the edge of the limb, touching the resting point of the slider, the dividend edge of which appears to have passed 4 of the primary, and 1 of the secondary, divisions on the scale ; while it has little more than 4 of the divisions on itself cut by another of the oblique lines of the scale; the quotient is therefore, taking these figures in succession, 414, and a little more.

The general rule for division is as follows: First.—If the divisor be taken on the first line of D, the dividend may be taken on either the first, or second lines of A. If it be taken on the first, the quotient will be found on the second, or middle line of B. If it be taken on the second, the quotient will be found on the third.

Second: If the divisor be taken on the middle line of D, the dividend may be taken on any of the three lines of A, and the quotient will be found on the corresponding lines on B.

Third: If the divisor be taken on the third line of D, take the dividend on the second or third lines of A. If it be taken on the second, the quotient will be found on the first line of B. If it be taken on the third, the quotient will be found on the second.

From this it follows, that each set of the Instrument gives solutions, to seven distinct questions in simple division. By attention to the rule, and to what has been stated above, respecting the divisions of the scales; any of the remaining six questions will be found solved on the figure, similarly to the example given above.

Example of the application of the Instrument to perspective, with the method of preparing the plans and pictures.

Suppose that figures 3 and 4 are the plan, and elevation of an octagonal solid: Let K L, fig. 3, be chosen as the ground line, and draw through its centre the perpendicular M N,—then, having determined on the distance of the picture, set off tenth parts of it on K L, on one or both sides of the centre as may be necessary, as 1 2; and on M N, as 9, 10, 11, and through these points draw parallels to K L, M N, as in the figure. On any line *a b*, divide a tenth of the distance of the picture into ten or one hundred parts, for a scale to measure the situations of the points between the parallel, and thus the plan will be prepared.

It will readily appear that lines, parallel to the ground line and to its perpendicular, may be put upon a plan lying at any distance from these primary lines, and by having their proper distances marked upon them, like the degrees of latitude and longitude on a map, they will answer equally well to measure from as the originals themselves; hence the application of this method, with the same facility and convenience, to plans of any extent, or to more than one.—An example will afterwards be given of the manner of finding the parallels for distant plans.

The paper on which the drawing is to be made, must now be prepared with a scale parallel to the horizon. One similar to that in fig. 5, will be easily made to great accuracy. Its parts may be made greater or smaller than those of the plan scale, according as the picture is required to be greater or smaller.

Then try with the compasses how many parts of the picture scale any number of the principal divisions of the scale A or B, of the instrument are equal to. In this case, ten divisions of the instrument are equal to three divisions of the picture scale. Extend therefore on any straight line, as *a b*, fig. 4, three parts taken from the plan scale, or three tenths of the distance of the ground line, and divide that distance into ten, the same number of parts as were taken at first from the Instrument, and by this scale measure the heights on the elevation above or below the horizontal line H O. Had the elevation been drawn to a different scale from the plan, the scale now described must have been made in proportion to the difference.

As the points or angles B and D, of the plan fig. 3, lie in K L, the ground line, it is only necessary to take their distances from the centre by the scale for the plan, and to set the ruler *r r*, of the instrument, to the corresponding points ·046 for B, and ·205 for D, on the picture scale fig. 5; then, as many parts as the elevation is found to measure by its scale *a b*, *a b*, above and below the horizontal line H O, make B B, D D, by the Instrument, above and below its centre division, or the zero of the scales, A or B, and the projection of these two angles will be done.

Next, the situation of the angle, A, fig. 3, will be found by the scale to be ·012 from the perpendicular, M N, and ·08 from the picture, K L, that is, 1·08 from the point of sight; therefore, set the plate *d* of the instrument to 1·08 on the divisor scale D, and let the dotted line, *k k*, represent the edge of the scale B, or the line *d e*; then set the lower limb, as represented by the dotted line F *i*, to 12 on the third dividend line, and *l* will be the place where the bearing point *p* of the slider would touch the limb, while its edge represented by, or in the line *l l* would cut on the third line of B, the number 111 agreeably to the rule: then, either supplying the decimal places in the mind, or observing the distance of the point from the centre line on the plan, the result obtained will show, that the ruler *r r*, is to be set to ·0111 of the scale under A A. Here it is obvious that only two of the figures of this quotient are required, or can be used.

The limbs are then to be set for the heights, to 7·5 above, and 4·0 below the zero of the scale A, by the middle line, these being the measures on the elevation fig. 4, above and below the horizontal line H O, by its scale *a b*; F *m*, F *n*, represent the limbs set to the heights and intersecting *k k*, in *a a*, or the places where the bearing points of the sliders would rest against the limbs; this being done, the stoppers, *c c*, will limit the length of A A, the perspective projection of that angle, which may be drawn with a pencil or pen between the stoppers, while the ruling edge *r r* is kept at the point of the scale previously found. The other angles, F, F, G, H, are projected precisely in the same manner, but the divisor for the the angle C being on a different line from the divisors of the other angles, another line on the dividend scale must therefore be used for the heights, as these are always to be taken on a line of A, corresponding to the line on which the divisor is taken on D, for the edge *d e* being set to the divisor 966 by the first line on D, it is plain that the former positions F *m*, F *n* of the limbs, will not as before answer for the heights, as the points of intersection *s s* will show; the limbs are therefore set to the heights on the first line of A. The scale not extending far enough for the height above the horizon, set *d e* to *t t*, or to 75 on D; put the slider up to 10, and rest the edge of the limb against the point *p*, which will then be in the place *t*. Fix the limb in that position by its thumb-screw, and bring down the slider to allow *d e* to be set to the divisor 966, as in the figure; then, as usual, set the bearing point of the slider to the edge of the limb, and its stopper will then limit the true perspective height as before.

It may be remarked, however, that in a case like this, when the height exceeds the numbers on the line whereon it should be taken, its half or quarter may be taken instead, and the perspective height found from that doubled or quadrupled, and this will be as easy to do as the method described above. Thus, F *m*, F *n*, fig. 5, represent the limbs set to half the height, and their intersections *s s* with *d e* are at half the perspective height, which might have been doubled for the whole, and in this manner vertical lines may be found of any length whatever beyond the limits of the instrument, and extended by a common ruler. But vertical lines of a greater length than the instrument readily admits are not often required for architectural drawings in perspective.

Because the limb in the position F *m*, is set to 7·5 by the middle line of A, while it is only at the half of 7·5 by the first line, it is evident, that it is only necessary to take the height on the following line to the true one, when its half is required, or on the next following for its quarter, when that can be done; but, if the divisor were on the third line of D, then the true line for the height would be the third of A, which has no succeeding line. If, however, the height were taken on the line preceding it, then one-fifth would be obtained, which being taken five times, would be the quantity sought. Thus, let 20 be the height by the third line, but let the slider be set to 2 or 20 on the second line, the quantity is evidently a fifth, and the perspective height or quantity would be in proportion; consequently, other heights exceeding 20 could be obtained in this manner.

The example which has been given above embraces every possible case that can occur, after the parallels have been drawn, in making any perspective projection by means of the instrument, but as its accuracy of working may be greatly increased without any more trouble for large pictures with long distances, if the plans be also large, and as the method may be employed with advantage where there are a number of successive small parts to be represented, it may be proper to explain how this can be done.

If the scale for the picture as above described were continued to 10 both ways from the centre, it would include an angle of 90 degrees; but, as 90 degrees, and consequently the whole scale, is never required in any picture, a scale containing the whole number of parts may be made to extend but a little way farther than the perspective representation; for, by measuring the distance of points from the perpendicular on the plan by a scale proportionally diminished to the picture scale, the dividends would be so much greater, while the divisors would remain the same; consequently the quotients would be higher, and would therefore correspond to higher numbers on the diminished picture scale. Thus, if the scale for the picture was made half the size it is at present, and the distances between the parallels to M N, fig. 3, on the plan, also one half, as shewn by the dotted lines between the former, while the parallels to K L of the picture remain as before, the quotients would obviously be double what they were before; consequently the projection would be made of the same size by a finer scale.

It is to be observed, that this method is merely calculated to lessen the effect of the errors of the instrument, for allowing its error to amount to 1, or unity, in any quotient from 100 to 1,000, (which is an ample allowance if it be well made, and care be taken in using it,) it will just amount to one of the least divisions of the picture scale, or a one-thousandth part, which, as has been seen, can be considerably lessened without diminishing the picture. But any error arising from the inaccurate drawing or measurement of the plan will neither be increased nor diminished by this method; it is always necessary, therefore, when it is adopted, that the plan be so large that its points lying between the diminished parallels may still be taken with sufficient accuracy for setting the instrument, which could not be done were they brought too close together, as would be the case on a small plan.

From the principles which have been explained, the projection of different buildings in the same view from their separate plans will readily appear to depend on the proper parallels or measuring lines being laid down upon them, according to the distances between the buildings and their relative positions to each other, and to the picture.

To render this more obvious, and also the method of finding the parallels on the distant plans, let fig. 9 be a general plan containing the sites or plans of two buildings, A and B; let C D be the ground line, E F a perpendicular to it in its centre, 9, 11, 12, &c. parallels to the picture, and 1, 2, 3, parallels to the perpendicular or radical at tenths of the distance of the picture apart. Now, if parts of the paper, as *a b c d* and *e f g h*, were cut out, the parallels upon them being marked with their proper numbers would serve equally well to project from as when connected with the rest of the sheet. But, suppose that separate plans are given, and that the distances between the buildings and the inclinations of their sides to one another are ascertained, it will be easy to find the proper parallels to each.

As an example, let A correspond to the plan, fig. 3, which has already been projected, and B to another plan, A B C D, fig. 10, and let them be found by measurement 100 feet apart from the point O of fig. 3, to the point *a* of fig. 10.

The measuring lines or parallels having been already determined, upon one of the plans fig. 3, draw through its point O the line O P, in the direction of the line of measurement between the buildings. In the same manner upon fig. 10, draw the line *a b* through the point *a;* then by the scale of feet to fig. 3, take the distance on C between the parallels, both to the picture and to the radial. The distance *e d* between the parallels to K L is 12 feet and about 9 inches, or 12·75 decimally; and P *c*, the distance between the parallels to M N, 30 feet—The whole distance, 100 feet, therefore, being divided by these numbers, will give the numbers of parallels between the plans. Thus 100 divided by 12·75 gives 7·87, that is ·787 of the distance of the picture, and by 30 gives 3·33, that is ·333 of the distance of the picture. To the first of these results, ·787, add 1·175, the distance of the point O from the eye, and the sum 1·962 will be the distance of the point *a* of fig. 10. Next from M N to O, fig. 3, there are ·084 of the distance of the picture; but since the line of measurement approaches to or cuts M N, subtract ·084 from ·333, and the remainder ·249, will be the parts of the distance of the picture which the point *a* of fig. 10 is distant from the perpendicular on the opposite side of it, to O of the other plan. Having thus determined the place of *a*, in relation to the picture and its perpendicular, draw through it the lines *c d*, *e f*, at right angles to one another, and inclined to *a b*, as K L, M N, fig. 3, are inclined to O P, and they will consequently be parallel to the picture and to its radial: then their distances having been found, it is very easy to set off from them the parallels 19, 20, 21, and 1, 2, 3, at the regular intervals; which being done, the projection is to be proceeded with as before. If the plans are drawn of different sizes, or scales, as in this case, then the spaces between the parallels upon them must be in proportion to their respective scales.

When the line of measurement between the objects (proceeding in a direction from the known point to the unknown) approaches to or cuts the perpendicular, as in the above case, the smaller distance or number of parallels taken from the greater, will give the place of the unknown point; but if, proceeding in the same direction, the line of measurement recedes from the perpendicular, then the sum of the distances must be taken to determine the place; and it is evident, that if the number of parallels lying between the points of measurement be less than the number between any one of them and the perpendicular, they must both fall on the same side of it.

As the usefulness of such an instrument must depend upon its accuracy, and not less perhaps upon the readiness with which it can be set to the parts of its different scales, fig. 11. will shew in what manner it might be made, so as to have great advantages over one of the above form, both in respect of accuracy and easiness of being read; at the same time that it will be free from some smaller defects, which are however of considerable importance in working it.

Instead of making the same divisions serve for the different numbers of the three lines on each of the scales, which has been found to cause uncertainty and loss of time in counting the parts, there is on each of the scales, a distinct set of divisions corresponding to each line of numbers; and the tenths of these divisions are likewise obtained on the dividend and quotient scales by verniers, corresponding to each set of divisions. Hence, when the line on which the number is to be taken is determined, the parts can be read with the greatest certainty. For the purpose of preventing any doubt as to the corresponding lines to be taken in the operations, they are numbered 1, 2, 3 and 4, on each of the three scales, and at the beginning of each of the lines so numbered on the divisor scale is a table, shewing the dividend and quotient lines corresponding thereto, or which may be used when that divisor line is used. Thus when the divisor line, No. 1, is employed, the figures under D in the table divide the lines on which the dividend may be taken, and opposite to these figures under Q, are others, denoting the line of the quotient scale, whereon the quotient will be found.

The instrument is represented set, and the following table contains all the divisors, dividends, and quotients, agreeably to its supposed adjustment.

Divisors.		*Dividends.*		*Quotients.*	
*L		L		L	
1	411	1	2414	3	5·87
	——	2	482	4	1·174
2	822	1	2414	2	2·93
	——	2	482	3	·587
	——	3	965	4	1·174
3	1644	1	2414	1	1468
		2	482	2	293
		3	965	3	587
		4	1931	4	1174
4	3288	2	482	1	1468
		3	965	2	293
		4	1931	3	587

Upon the first divisor line the edge *g g* cuts the number 4·11. Under the letter D, at the beginning of the line we find 1, which shews that a dividend may be taken on the first line. The number 24·1 is accordingly passed on that line by the edge *a b* of the slider, while the vernier of the line is also made to stand at 4, which, with the former three figures, makes 24·14. The quotient is then found on the third line, of the quotient scale, as the figure 3 under 2 on the divisor line, indicates, and is 5·87 and a little more, the edge *a b* having passed 5·8 on the third line of the scale, while the vernier stands at 7. In the same manner the other numbers in the table may be found.

---

* The figures under the letter L denote the lines of the scales on which the numbers are found. The decimal points are to be supplied according to circumstances, and are therefore left out in the Table; but in drawing them no alteration to them is required, though it was necessary in explaining the principles.

The secondary divisions on the first and fourth lines, which have been passed by the edges *a b* of the sliders, will be best counted opposite to the lower extremities of the vernier, which are placed so much lower for this purpose; but the divisions on the second and third lines being larger and less hid by the connecting bars of the sliders, the edges themselves are made use of. As the edges *a b* of the sliders cannot be brought to the ends of the scales, the edges *d f* can be taken by using the lower pins *e*, instead of the upper ones *c*, should it be necessary. These pins, and also the centre pin of the lines, are all of the same thickness. The edges of the limbs are tangents to the circumference of their centre pin, and the stoppers are opposite to the centre of the pins and to the quotient slider. The quotient and dividend scales consist of thin plates of brass, C D and E F, with two narrow thin slips rivetted along each, so as to leave a dove-tailed groove between them for the sliders. The edges of these grooves must be straight and parallel to each other, and likewise to the straight or ruling edges of the quotient scale. Upon these narrow slips of brass the scales are to be engraved, or upon thin slips of ivory planted over them.

The sliders are made of steel, covered with ivory for the vernier divisions; and the parts in the grooves are connected by narrow steel bars *a b* and *d f* with the outside pieces. The plate C D of the quotient scale is firmly connected with the stock A A B B by screws, and also with the brace K at the top, and can thereby be adjusted or made square, the screw pin at D serving as a kind of pivot or center. For greater security the plate is brought across the stock and firmly screwed to it by pins, which are hid under the plate B B. In the dove-tailed and parallel grooves G are steel sliders of the same length as the brass plate or cover H. To these sliders are screwed the plate E F of the dividend scale, and the opposite side L of the frame, with the cross or square head of which the plate E F is also connected.

The screws under the cover H which connect the plate E F to the steel bars, have broad thin heads, and the holes through which they pass in the plate are lengthened cross-ways to it, while the screw pin connecting the upper end of it with the square top L acts as a centre, by which means the dividend scale can be made parallel to the quotient scale. To the outer side of the stock, as will be seen by its section, fig. 12, is screwed a shoulder *m*, which may occasionally be taken off, and the lower edge of the stock made to move along the straight edge of a piece of wood fixed upon the drawing board, by which the horizontal line may be made farther from the bottom if necessary. The outside edge of the plate E F, as will be seen by its section fig. 13, is turned down, to produce greater stiffness; but the other edge is not, as it may occasionally have to be brought over a part of the quotient scale. At intervals of a few inches there are thin bits of ivory *n* pinned to the under side of the quotient scale, to keep the brass from soiling the paper, as shewn in figs. 12 and 13. This may be done likewise under the brace K.

In making use of this instrument there will seldom be occasion

Plate 4.

Mr. W. Warcup's Curvagraph.

Fig. 1.

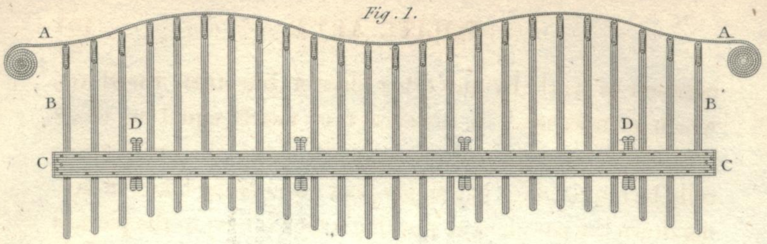


Fig. 3.

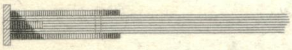


Fig. 4.

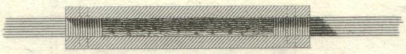


Fig. 2.

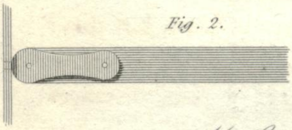
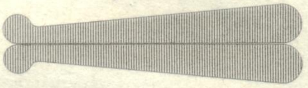
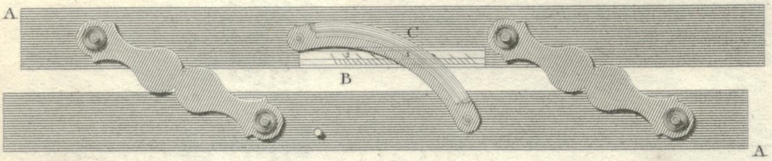


Fig. 5.



Mr. G. Wood's Parallel Rule.

Fig. 6.



Mr. Hall's Angulometer.

Fig. 7.

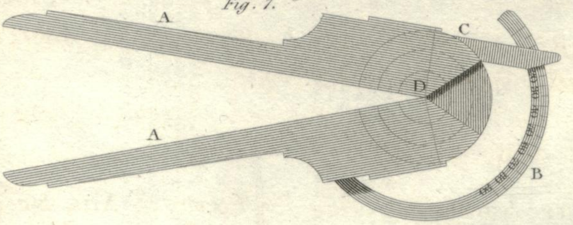


Fig. 8.

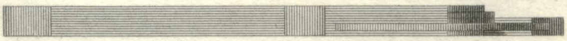


Fig. 9.

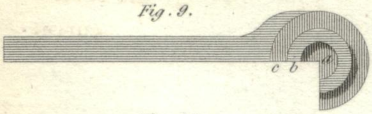


Fig. 11.

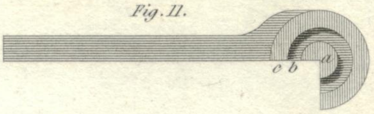


Fig. 10.

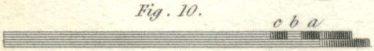
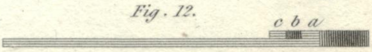


Fig. 12.



M. A. Nicholson delin.
Edmd. Turrell, sculp.

occasion to work by any other divisor line than the third, which comprehends a distance very nearly equal to twice that of the picture, and consequently more than will generally be required for any single plan; care being taken in laying down the parallels, to put that which is next to the picture and is numbered 1·1, either upon the farthest or nearest point of sight. There may likewise be some advantage in using the third divisor line, as the dividends and quotients are on the corresponding lines of their respective scales.

Any of the other sets of numbers may be used, but these will be found most useful in the projection of streets, or of a number of buildings in the same view, at great distances from one another.

D. DICK.

The SILVER MEDAL *and* TEN GUINEAS *were this Session voted to Mr.* W. WARCUP, *of Dartford, Kent, for a Curvagraph. The following Communications were received from him on the subject, and one of the Instruments is preserved in the Society's Repository.*

SIR,

I BEG leave to lay before the Society of Arts, &c. an instrument of my invention for describing *curve lines*, which I purpose calling the *Curvagraph.*

It is not in my power to mention the various purposes to which this instrument may be applied, as I have hitherto used it only in mechanical and ship drawing, the several curves of which may be drawn and constructed much more easily and expeditiously by means of this, than by any other method at present in use.

To naval draftsmen, I presume, it will be a valuable acquisition, as it will supersede the tedious operations they have recourse to, when they have no mould that will answer their intended curve, and it will enable them to copy drawings with the greatest accuracy and ease.

As the instrument is before the Society, I need not enlarge upon the principles on which it is constructed, or the mode of using it, as I trust it will be clearly understood by inspection.

Should the Society favour it with their patronage, any reward they may think proper to honor me with, will be gratefully acknowledged by their

Most obedient humble Servant,

W. WARCUP.

High-street, Dartford, Kent,
February 17, 1817.

To A. Aikin, Esq. Sec.

Certificates.

I do certify that the Curvagraph, invented by Mr. Warcup, has proved to be a very useful and valuable instrument in delineating geometrical drawings of machinery, and that by the aid of that instrument much time has been saved in the course of Mr. Warcup's employment upon a long series of drawings made by that gentleman under my direction.

M. I. Brunel.

Chelsea, February 15, 1817.

GENTLEMEN,

UNDERSTANDING that Mr. Warcup has submitted to you his ingenious instrument and invention, the *Curvagraph*, allow me to say that I consider it an original invention, and one of considerable utility in engineering; but especially so in naval architecture, as it will not only much facilitate the forming of naval drawings, but avoid, in a great degree, the necessity of the present practice of using moulds, and the cause of great delay and expense.

I have the honour to be,
Gentlemen,
Your most obedient Servant,
GEORGE DODD.

No. 8, Oxford-street, March 12, 1817.

To the Committee of Mechanics, &c. Society of Arts, &c.

I DO hereby certify, that, having examined the *Curvagraph* invented by Mr. WARCUP, I am fully convinced that it is admirably adapted to promote dispatch when making copies of drawings, and evinces much ingenuity in its construction.

W. STONE.

Deptford Yard, February 25, 1817.

To the Society of Arts, &c.

I HEREBY certify, that the Curvagraph invented by Mr. WARCUP has been used under my observation, with very great advantage in ship drawing, and I have no doubt but in drawing curve lines generally, much valuable time may be saved by the use of this instrument, and it is far preferable, in my opinion, to any thing that has hitherto been offered for such a purpose. I beg to recommend it as possessing a considerable degree af merit and ingenuity.

HENRY MAUDSLAY.

Lambeth, March 5th, 1817.

To the Society of Arts, &c.

Reference to the Engraving of Mr. WARCUP'S *Curvagraph, Plate* 4.

FIG. 1, A A a plain slip of whalebone forming the ruler.

B B graduated ribs at right angles to the ruler, with which they are connected by small joints of brass, fig. 2, 3.

C C a beam, consisting of a case of whalebone containing slips of cork or of any other elastic material, and perforated to allow the ribs to pass through. Fig. 4, a section of the same.

D D bolts, consisting of two pieces of wood or of ivory, by the pressure of which against the elastic slips of cork the ribs are either kept in their place or released at pleasure. Fig. 5, the bolts on a larger scale.

The SILVER MEDAL *and* TEN GUINEAS *were this Session voted to Mr.* GEORGE WOOD, *of Chapel-street, Curtain-road, for a Parallel Rule. The following Communication was received from him on the subject, and one of the Rules is preserved in the Society's Repository.*

SIR,

I BEG leave to lay before the Society of Arts, &c. an improvement which I have made on the parallel rule, an instrument much used, especially by architectural and naval draftsmen. My improvement consists in adding a graduated scale of ivory and a brass arc, by means of which the artist is enabled at one operation to set his parallel lines at certain and precise distances from each other, instead of trusting, as is too often the case, to the accuracy of his eye rather than take the trouble of drawing a perpendicular, and dividing it by a scale of parts. The brass arc has the farther advantage of strengthening the instrument, which is a matter of some importance, particularly in rules of unusual length.

I remain, Sir,
Your obedient humble Servant,

GEORGE WOOD.

No. 22, Chapel-street, Curtain-road, Nov. 4th, 1816.

To C. TAYLOR, M. D. SEC.

Description of the Instrument, Plate 4, Fig. 6.

A A, the rule.

B, a scale of ivory divided into inches and one-twelfth parts.

C, an arc of brass, the incidence of the outer edge of which on any of the divisions of the ivory scale determines the distance between any two parallel lines.

The SILVER MEDAL *and* TEN GUINEAS *were this Session voted to Mr.* WILLIAM HALL, *of Lambeth, for an Angulometer. The following Communication was received from him on the subject, and one of the Instruments is preserved in the Society's Repository.*

SIR,

I BEG leave to send to you for the approbation of the Society of Arts the model of an angulometer of my invention. The peculiar advantage of this instrument is, that it opens from one to ninety degrees without any part of the joint coming into the internal angle. Hence, when any angle, solid or otherwise, has been measured by this instrument, it may immediately be transferred to paper without any farther operation, merely by drawing a pencil along the internal edge of the legs.

I am, Sir,

Your humble Servant,

WILLIAM HALL.

No. 9, Belvidere-place, Narrow Wall, Lambeth,
February 28th, 1817.

To C. TAYLOR, M. D. Sec.

Description

Description of the Instrument, Plate 4.

Fig. 7, A A, the legs.

B, a graduated arc.

C, the index.

D, the point of the angle.

Fig. 8, section of the above.

Figs. 9, 10, 11, 12, show the construction of the joint.

a, *b*, *c*, Wards working one on the other, and forming the joint.

◆